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dro-Electric Power
from
The River Godavari
For The Proposed Steel Works
In
H. E. H. The Nizam's Dominions.

READ BY

Nawab Ahsan Yar Jung Bahadur,
C. E. (Cooper's Hill), M. I. E. (Ind).,
Retired Chief Engineer & Secretary, P.W.D.,
H. E. H. The Nizam's Government,
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HYDRO-ELECTRIC POWER FROM THE RIVER GODAVARI. FOR THE PROPOSED STEEL WORKS.

THE river Godavari is one of the two main rivers that flow across the plateau of Deccan. Rising from the western ghats the river drains in all 1,21,500 Sq. miles of catchment, of which more than 48,000 Sq. miles are contributed by The Hyderabad State. Hyderabad has therefore a much greater claim on the use of its waters, than other contributors, viz., Bombay, Madras and Central Provinces. Hyderabad has not, so far, made any effort to utilise its water, except for the Nizamsagar Project which lies across its tributary, the Manjeera. Bombay has been utilising this river from a very long time by irrigation under the Godavari canals, and also by harnessing many of its tributaries in the higher reaches. Madras however is the greatest user of this river due to possession of its delta, where irrigation was started in 1877 and today 7,87,578 acres in Abi, and 2,31,930 acres in Tabi are irrigated. It is time that Hyderabad makes some efforts also to utilise the waters of this huge river.

Unfortunately, the river does not offer suitable sites for a storage reservoir in the Dominions. The river passes mostly through flat country, and it is only after the bridge at Soan, (Nirmal Taluq) that it enters a hilly tract. From here, the river starts falling as a rapide with a fall of nearly 482 ft. in 43 miles up to the junction with Kaddam; but for economical storage, sites below the Soan bridge do not appear to be promising. However, several sites, from Manchirial, on the Kazipet Balharsha Railway, to the Railway bridge at Basar, have been carefully investigated and are discussed below (refer map attached).

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Site No. I. is a little below Manthani village. Here the river cuts a barrier of hills and passes through a narrow gorge, but suitable foundations are not available. It has a further disadvantage, in as much as, the submergence is costly, and the area commanded in Hyderabad State is small and disproportionate for a scheme, on a huge river like the Godavari.

Site No. II. is near Ponkal village. Here the flanks are low and the site is situated midway on the rapide, between Soan Bridge and Kaddam river junction, with a steep bed fall above. Hence it is not at all a suitable site for a storage reservoir. Even for an anicut, the site is too low down the rapide, thereby resulting in a loss of good deal of power.

Site No. III. is between Kamalkotta and Chinthalchanda. It is only 6 miles above the site No. 2 and is very similar to it. Hence, it is not suitable for either a storage dam or a diversion weir.

Site No. IV. is close to Chinthalchanda village and has very flat flanks. The river bed here is about 30 to 40 ft. lower than that at Parapally higher up. A storage reservoir of even 15,000 M.Cft. capacity will submerge many villages, tanks, and also the fully developed Laxmanchanda irrigation project. A low anicut here will mean a loss of good deal of power.

Site No. V. is close to Parapally village and seems to be fairly well situated for an anicut or pick-up weir.

Site No. VI. is just above site No. V. There is not much difference between it and site No. V. The two sites are close together and the one near the village, that is, site No. V, seems better.

Site No. VII. is where the bridge at Soan has been constructed. It would have been practicable to convert the existing bridge into a barrage, by putting in gates, but unfortunately sufficient storage is not available.

Sites Nos. VIII & IX. are close together, near Kishtapuram village. Site No. VIII adjoining the village has very flat flanks. Site No. IX is above site No. VIII; the bed here is more rocky and is about 5 ft. higher with steeper flanks. Hence, site No. IX is more suitable, and is the only economical site available for a reservoir in this reach of the river Godavari. Although, the site is not as good as other sites selected for reservoirs on the river Tungabhadra or Kistna, it is the best available. Therefore, site No. V at Parapally has been finally selected for a pick-up weir and site No. IX above Kishtapuram village for the construction of a storage reservoir.

The most suitable F.R.L. for the reservoir above Kishtapuram appears to be R.L. 1080; at this level the ~~gross~~ capacity is about 52,000 M.Cft., which is rather low, compared to the yield of a large river like Godavari. The F.R.L. cannot be raised any further, as it is likely to submerge the railway bridge at Basar with some adjoining length of Hyderabad Godavari Valley railway line. It is also recommended that the reservoir be constructed in two stages, the first stage with F.R.L. 1065, thus minimising submergence, and after development to raise the F.R.L. to R.L. 1080 by putting on 15 ft. gates. In fact the further raising of F.R.L. to R.L 1080 may not be necessary at all, if, as contemplated and discussed by the Consulting Engineer in the Tungabhadra Scheme, this reservoir is also to be utilised as a distributing dam and large storages provided on tributaries of the Godavari higher up, like Nizamsagar and others. The cost of the reservoir is high, and considering the present requirements it need not be constructed for some time to come. It is advisable, therefore, to divide the Godavari scheme into two stages, with two Sub-divisions again of stage I and II, both for development of power and for irrigation as explained below.

1st Stage.

An anicut with crest at R.L. 986 be constructed at Parapally (site No. V) which is admirably suited for a diversion weir and will be fairly economical. A power canal is to be taken off from the left flank with sill at 975 and after 14 miles carried into a forebay reservoir at Iqbalpur, having a capacity of 1,000 M. Cft. The reservoir will serve both as a silting tank and also as protective storage, against any accidents in the power canal. The pipe line is to be about 1½ miles long, and water can be dropped 150 feet from R.L. 960 to R.L. 810 to the generating turbines. The tail water after the drop will be carried in a canal extending further down by another 12 miles to a forebay R.L. 798 and dropped 150 feet to R.L 648 directly into the river Godavari, above the junction with Kaddam. The power canal is to be for a maximum discharge of 3,000 cusecs with a full supply depth of 10 feet. This quantity will be available for at least six months in the year from 15th July to 15th January, and during the remaining six months an average inflow of at least 300 cusecs can be expected. It will thus be possible to generate from both the drops amounting to three hundred feet, 6,000 K.W. continuous (Primary) and 60,000 K.W.(Secondary) for 6 months. If however, only the 1st drop (Part I of 1st stage) is utilised for the present, the power developed will be 3,000 K.W. continuous and 30,000 K.W. for 6 months.

As regards irrigation possibilities at this stage, it is proposed to construct a pick-up weir at Goadcherla about 10 miles further down the river from the 2nd drop and irrigation carried on the left bank in Adilabad District. The weir (really a low dam) will be constructed with its crest at R.L. 636 and a canal of 3,000 cusecs taken off on the left bank with sill 625. The area commanded by this canal is 200,000 acres of which 100,000 acres of rice in Abi can be irrigated, apart from filling up tanks for Tabi. As half of the dry weather flow may have to be let down into the river for lower riparians, the remaining half, i.e., 150 cusecs can be utilised for irrigating about 6,000 acres of Tabi directly under the canals.

It may be stated here that the irrigation will be mostly in the areas lately affected by famine: namely Sirpoor and Chinur Taluqs in Adilabad District.

The cost of the complete Hydro-power scheme (Stage I) is estimated to be Rs. 212 lacs and will yield a net revenue of 12.40 lacs; representing a return of 5.85% (details vide appendix 'A').

It may be mentioned here that the very lowest rate for power, viz., 1½ pies per K.W.H. has been proposed. This special rate is for supply of power to the proposed Steel Works and has to be as low as Government can afford.

The cost of irrigation scheme at this stage is estimated to be Rs. 582 lacs and is expected to yield a net revenue of Rs. 50.40 lacs; representing a return of 8.66% (details vide appendix 'A' page 2).

The net revenue however from the combined scheme is expected to be as under:—

From Power	....	O.S. Rs.	12.40 lacs.
From Irrigation	....	„	50.40 „
	Total	„	62.80 „

This represents a return of 7.91% on a capital expenditure of O.S. Rs. 794 lacs.

As the capital cost of the whole of the combined Irrigation and Power scheme in the first stage is O.S. Rs. 794 lacs, it seems advisable not to sink such a large capital at once but to take up the works gradually as follows:—

Part I. To construct, at commencement, only those works that are absolutely necessary to provide Hydro-power for establishing the steel works, and utilise the tail water for irrigation. The costs of these works, both for power and irrigation are shown in detail in appendix 'B' (pages 1 and 2). The cost of Hydro-power scheme, generating about 3,000 K.W continuous and 24,000K.W. for 6 months, is Rs.115 lacs and the net return is 5.39% notwithstanding that lowest possible rates, viz., one and half pies per K.W.H. for 24,000 K.W. for 6 months and 3.84 pies per K.W.H. for 3,000 K.W. continuous are proposed to be charged. The irrigation scheme to utilise the tail water of about 3,000 cusecs costs Rs.182 lacs and the net return expected is 4.46%. The combined scheme however is to cost Rs. 297 lacs yielding a net return of 5.16% (vide appendix 'B' page 2). Part II (Power) of this stage may be taken up as soon as more power is required by the steel works and irrigation is developed under the left bank canal from the Goadcherla anicut. The power scheme, as explained above, will consist of carrying the tail water further down to the second drop in a power canal of 12 miles and dropping another 150 feet at the turbines on the banks of the river Godavari.

Part II. (Irrigation) This scheme is to be further developed by constructing a right bank canal of 8,000 cusecs from the Parapally anicut on the right bank of the river Godavari with sill 975.00 and utilised entirely for the Abi rice crop. The command under the canal is more than 10 lacs acres, of which 4,80,000 acres can be irrigated in Abi. The irrigable area will thus be about 50% of the command which is reasonable as in the taluqs commanded, viz., Jagtial, Kareemnagar and Sultanabad, the soil is most suitable for paddy and the ryots are used to irrigation. Here again this large area will be protected against famine. The cost of the irrigation scheme will be Rs. 582 lacs and will yield a net revenue of Rs. 50.40 lacs representing a return of 8.66%, vide Appendix 'A'. The combined power and irrigation scheme at this stage will cost Rs. 794 lacs and will yield a net revenue of Rs.62.80 lacs representing a return of 7.91%, vide appendix 'A'.

2nd Stage.

This will comprise the construction of a reservoir above Kishtapuram with a capacity to insure a continuous flow of 3,000 cusecs for the power canal. So far only preliminary investigation has been carried out and according to this an effective storage of 52,000 M. Cft. with F.R.L. 1080 may be available. As stated above, the construction of the reservoir can also be taken up in two stages. In the first stage it may be constructed to F.R.L. 1065 and later on with the increase in the demand for more power, the F.R.L. can be raised to R.L. 1080 by providing 15 feet gates.

After completion of stage II the total power generated from the two drops will be 60,000 K. W. continuous. The capacity of the Kishtapuram reservoir at R.L 1080 is 52,000 M. Cft. and it will be possible to supplement 2,700 cusecs in the dry months so as to provide a perennial flow of 3,000 cusecs in the power canal. Due to the perennial discharge of 3,000 cusecs in the power canal it will be possible to irrigate under the left bank canal from Parapally anicut ~~2 lacs of~~ acres of Abi, 75,000 acres of Tabi and 25,000 acres of cane. The cost of the full scheme for power in this stage will be Rs. 275 lacs and will give a net revenue of Rs. 33.30 lacs representing a return of 12.10%, vide appendix 'C'. The cost of the scheme for both power and irrigation combined will be Rs. 1197 lacs and will give a net revenue of Rs. 103.46 lacs representing a return of 8.64%, vide appendix 'C'.

The total utilisation of the waters of the river in the complete scheme will be about 1,50,000 M. Cft. For a big river like the Godavari having a catchment area of 42,500 Sq. miles at the site, a utilisation of 1,50,000 M. Cft. by Hyderabad is much below its share to the waters of the river to which she is entitled. Hence, there can be no objection from other claimants to the utilisation of 1,50,000 M.Cft. by Hyderabad.

The above preliminary investigations are only intended to give a full picture of the ultimate scheme and its utilisation. Even before the construction of the Kishtapuram Reservoir, the quantity of power available will be fairly large, viz., primary 6,000 K.W continuous and 60,000 K.W secondary for 6 months which can be utilised entirely for the development of steel industries. The production of 1,00,000 tons of steel annually in the first stage, notwithstanding the very cautious report of Dr. Heron is easily possible. As shown under the report on Steel manufacture, electric furnaces are more suitable for the production of steel by the direct process, and this has now been admitted by Dr. Heron and Indian experts.

With the industrial development in our Dominions, I am certain that an output of 300 tons per day of steel will not be excessive. As to the remarks of Dr. Heron that most of the alloys for manufacturing the steel will have to be imported; it may be mentioned that manganese and chromium are available in large quantities in Central Provinces and Mysore; Nickel has been found in Travancore and it will be possible to manufacture Aluminium and Silicon in our Dominions. Further, it is not necessary at present to manufacture the whole of the output as alloy steel. With the prices now prevalent and protection in our Dominions, a fairly large profit can be obtained even in the manufacture of mild steel which can be all utilised in our Dominions alone. The investigations so far have proved without doubt that a low grade ore of 40% iron contents can be easily converted by magnetic concentration to an ore of 60% contents and utilised for making steel in electrical furnaces by the direct process.

Finally, I am of opinion that unless the Tungabhadra scheme has to be taken up immediately, the Government should devote their full attention to this scheme, as all the works and submergence will be in our Dominions. Moreover the agricultural prospects are much better, the soil being more suitable, and the cultivators willing to utilise the water. In fact, if it was not a case of protection of our rights vis-a-vis Madras, I would not have recommended Government to take up the Tungabhadra scheme, at least for the present.

Of all the large combined Irrigation and Power schemes I have investigated, I am definitely of opinion that the Godavari Project will be the most remunerative, both as regards Irrigation, and Power. I hope the Government will not shelve this scheme, simply because they have to join Madras in taking up the Tungabhadra scheme. Madras Government may be keen but as far as I can see, their desire seems to be half hearted. Now, owing to war I am not sure whether the scheme will be taken up in the present decade; as such, it seems inadvisable to delay other highly remunerative schemes. Even if Madras Government became so active as to start the work shortly, I think the Government will be well advised to commence the Godavari scheme as well, as an Industrial undertaking and not merely as an irrigation work.

The position in India before the war was exactly similar to what it was in Europe more than 100 years ago; even now, power required is provided generally by steam or oil engines. In India as in other countries rapid expansion of Industries has followed after the great war. It became evident also that application of electric power to industries results, not only in economy as to cost of production, but indirectly leads to material prosperity of the country. Electric service considerably helps industrial progress also, as factories need no longer be established at power sources; power can be had every where and manufacturers are free to devote their energy and time to other elements, such as, transportation, markets, availability of raw materials and labour.

Moreover, electric power purchased from large generating installations obviates the purchase of boilers and engines for factories, and this releases large sums of capital for other purposes; thereby considerably facilitating the establishment of new factories, large or small all over the country.

In our country, the great need of the day is to improve the condition of the rural population, and keep them as far as possible on their farms in their villages. Rural electrification will provide the farmer with cheap and reliable power not only for his farm work but will bring more light and cheer in his home which is badly needed. In all countries, electric power is used economically for pumping of water for irrigation, corn shellers, rice hullers, threshers, flour grinders, cream seperaters and many other small local industries too numerous to be mentioned; hence, for rapid material progress of a country, rural electrification is essential.

Sd/- Ahsan Yar Jung.

NAWAB SALAR JUNG BAHAD

Appendix 'A'

(a). Cost of Hydro-Power Scheme, 1st Stage.

Power canals, capacity 3,000 cusecs and forebays at first drop and second drop.	O.S. Rs.77.00 lacs
Pipe lines at first & second drops.	„ 24.00 „
Generating plants (as per details below) at both the drops complete.	„ 80.00 „
Power Houses, Buildings & Quarters.	„ 10.00 „
Transmission lines etc. (For the present)	„ 21.00 „
Total O.S. Rs.	212.00 „

Details of generating plant and Machinery :-

6 - 8000 K.W. Turbo Alternators 6000 volts 3 phase 50 cycles. 4 - 4000 -do- -do- -do-	B.G.Rs.48.00 lacs
Cost of tests.	„ 0.60 „
Switch gears.	„ 3.00 „
10 M.G. sets complete.....	„ 0.90 „
10 P.S. Transformers .... 6.6/66 K.W. 1,000 K.V.A.	„ 5.10 „
2 cranes 25 tons.	„ 0.30 „
10 miles of transmission for the station 33 K.V. double transmission lines.	„ 3.00 „
Cabling for Power House.	„ 0.90 „
Instruments, Tools etc.	„ 0.80 „
Freight, erection etc.	„ 5.40 „
Total B.G. Rs.	68.00 „
Add exchange	12.00 „
Total O.S. Rs.	80.00 „

Revenue :-

6000 K.W. continuous (primary) for distribution at 3.84 pies per K.W.H.		O.S. Rs. 10.50 lacs
48,000 K.W. for 6 months supply to steel works at a special rate of 1½ pies per K.W.H.....		„ 16.20 „
Total		„ 26.70 „
Deduct ¼ for working expenses, supervision etc.	5.30	
Deduct depreciation etc. on plant	9.00	„ 14.30 „
Net Revenue		„ 12.40 „

This represents a return of 5.85% on Rs. 212 lacs.

Cost of Scheme First Stage:-

(b). Irrigation :-

Anicut at Parapally.	O.S. Rs. 12 lacs
Anicut at Goadcherla.	„ 20 „
Cost of rice canal for 8,000 cusecs from the right flank at Parapally anicut 80 miles together with distributaries.	„ 400 „
Cost of 75 miles canal for 3,000 cusecs from the left flank together with distributaries.	„ 150 „
Total	„ 582 „

Revenue from Irrigation:-

480,000 acres of Abi under the right bank canal from Parapally at Rs. 10/- per acre.		O.S. Rs. 48.00 lacs
100,000 acres of Abi under the left bank canal from Goadcherla at Rs. 10/- per acre.		„ 10.00 „
6,000 acres of Tabi under the left bank canal.		„ 0.60 „
Total		„ 58.60 „
Deduct maintenance charges.	5.86	
Deduct cost of revenue collection at 4%	2.34	„ 8.20 „
Net revenue		„ 50.40 „

or nearly 8.66% on Rs. 582 lacs.

(c). Combined Irrigation and Hydro-Power Scheme:-

Cost of Irrigation Scheme.	O.S. Rs. 582 lacs
Cost of Power Scheme.	„ 212 „
Total	„ 794 „
Net revenue from Irrigation.	„ 50.40 „
Net revenue from Power.	„ 12.40 „
Total	„ 62.80 „

This represents a return of 7.91% on the combined Scheme costing Rs. 794 lacs.

Appendix 'B'

PART 1 OF FIRST STAGE:-

HYDRO-POWER:-

3,000 cusecs Power Canal upto the 1st drop of 150 feet.	O.S. Rs. 30 lacs
Forebay.	„ 15 „
Pipe line 1st drop.	„ 16 „
Plant and Machinery (3 - 8000 K.W. & 2 - 4000 K.W. Test attenders).	„ 40 „
Power House, Quarters etc.	„ 5 „
Transmission line to Steel works 45 miles.	„ 9 „
Total	„ 115 „

REVENUE:-

3,000 K.W. Primary (continuous) at 3.84 pies per K.W.H.		O.S. Rs. 5.25 lacs
24,000 K.W. for 6 months at one & half pies per K.W.H.		„ 8.10 „
Total		„ 13.35 „
Deduct $\frac{1}{4}$ for working expenses etc.	2.65	
Deduct depreciation.	4.50	„ 7.15 „
Net revenue		„ 6.20 „

This represents 5.39% on the total outlay of Rs. 115 lacs.

PART I IRRIGATION:-

Anicut at Parapally.	O.S. Rs. 12 lacs
Anicut at Goadcherla.	„ 20 „

Cost of 75 miles of canals & distributaries for the Goadcherla on the left flank to carry 3,000 cusecs.	O.S. Rs.	150	lacs
Total	,,	182	,,

REVENUE FROM IRRIGATION :-

100,000 acres of Abi at Rs. 10/- per acre	,,	10	,,
6,000 acres of Tabi at Rs. 10/- per acre	,,	0.6	,,
Total	,,	10.60	,,
Deduct maintenance. 1.06 Deduct revenue collection Charges 0.42	,,	1.48	,,
Net revenue	,,	9.12	,,

This represents a return of 4.46% on Rs. 182 lacs.

1st STAGE PART I.

Combined Irrigation and Hydro-Power :—
Capital Cost :—

Anicut at Parapally.	O.S. Rs.	12.00	,,
Anicut at Goadcherla.	,,	20.00	,,
75 miles of canal 3,000 cusecs capacity.	,,	150.00	,,
Power canal and machinery plant and transmission lines to steel works,	,,	115.00	,,
Total	,,	297.00	,,

NET REVENUE :-

Irrigation.	,,	9.12	,,
Power.	,,	6.20	,,
Total	,,	15.32	,,

This represents a net combined return of 5.16% on Rs. 297 lacs.

Appendix 'C'

Cost of Scheme 2nd Stage :-

(a.) Irrigation :-

Cost of Kishtapuram dam.	O.S. Rs.	340	lacs
Cost of 1st stage as per Appendix 'A'.	,,	582	,,
Total	,,	922	,,

Revenue :-

Under left bank canal from Goadcherla Anicut :—			
100,000 acres of Abi at Rs. 10/-	,,	10.00	,,
75,000 acres of Tabi at Rs. 10/-	,,	7.50	,,
25,000 acres of Sugarcane.	,,	8.75	,,
Under right bank canal from Parapally anicut :—			
4,80,000 acres of Abi at Rs. 10/-	,,	48.00	,,
66,000 acres of Tabi at Rs. 10/-	,,	6.60	,,
Total	,,	80.85	,,

Deduct :-

Maintenance charges. – O.S. Rs. 7.46 lacs Revenue collection ,, – ,, 3.23 ,,	,,	10.69	,,
Net Revenue	,,	70.16	,,

This represents 7.60% on O.S. Rs. 922 lacs

(b) Power:-

Addition of 2 more 8000 K.W. sets.	O.S. Rs.	16	lacs
Add cost as per Appendix 'A'.	,,	212	,,
Extra transmission lines.	,,	47	,,
Total	,,	275	,,

48,000 K.W. to Steel Works for 6 months at 1½ pies per K.W.H.	16.20 lacs	O.S. Rs. 37.80 lacs
and for 6 dry months at 2 pies per K.W.H.	21.60 „	
12,000 K.W. continuous for general distribution at 3.84 pies per K.W.H.		„ 21.00 „
Total		„ 58.80 „
Deduct ¼ for working expenses etc.	13.35 lacs	
Deduct depreciation etc.	12.15 „	„ 25.50 „
Net revenue		„ 33.30 „

This represents a return of 12.10% on Rs. 275 lacs.

(c.) Combined Irrigation and Power:-

Cost:-

Irrigation Scheme.	O.S. Rs. 922 lacs
Power „	„ 275 „
Total	„ 1197 „

Net Returns:—

Irrigation	O.S. Rs. 70.16 lacs
Power	„ 33.30 „
Total	„ 103.46 „

This repersents a return of 8.64 % on Rs. 1,197 lacs.

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